

Fact sheet on Danish Power Systems' new technology

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Danish Power Systems has developed a new and highly advanced technology for the next generation of PEM fuel cells. Today the most important fuel cells are PEM or PEMFC (Polymer Electrolyte Membrane Fuel Cell), PAFC (Phosphoric Acid Fuel Cell), and SOFC (Solid Oxide Fuel Cell).

All types of fuel cells produce electricity based on an electro-chemical process. Fuel cells' major strength is their ability to produce energy in an efficient and environmentally friendly way. However, the fuel – hydrogen – is associated with technical problems. Worldwide hydrogen has become a hurdle for scientists and economists to deal with. Hydrogen is expensive to produce, and both difficult and expensive to store and distribute.

Danish Power Systems has developed a PEM fuel cell system, which solve many problems regarding the use of hydrogen. The scientists have also successfully resolved a number of engineering problems. The result is a system that, for the first time, can make the PEM fuel cell system a paying business due to high efficiency and reduced costs.

The system consists of a PEM fuel cell, that can be connected to other fuel cells into a stack. A reformer to match the stack reforms methanol into hydrogen. This method is well known, but the significant advantage of the system is the new material, PBI (polybenzimidazol), used for the membrane. PBI is a thermally high resistant material and less expensive than Nafion®, which is used for traditional PEM fuel cells. As a consequence of PBI's unique properties:

- The operating temperature of the PEM fuel cell is able to reach 200°C instead of approx. 100 °C as for traditional PEM fuel cells. Due to the increased operating temperature:
- Hydrogen water balance problems have been removed
- The cell is able to handle at least 3 % carbon monoxide without being destroyed. Hence, the reformer gas needs no cleaning.
- The reformer is able to function using the surplus heat of the PEM fuel cell only. Hence, no extra energy is needed.
- The PEM fuel cell has a high current power performance – 1.0 A/cm² at 0.5 V, i.e. 0.5 W/cm²
- The PEM fuel cell has a long lifetime – >5000 hours demonstrated at 0.5 A/cm² and 0.5 V.
- Cooling of the PEM fuel cell has become easier and less expensive.

For further information:

Hans Aage Hjuler, tel: (+45) 45 87 39 34.

E-mail: daposy@daposy.com Web: www.daposy.com